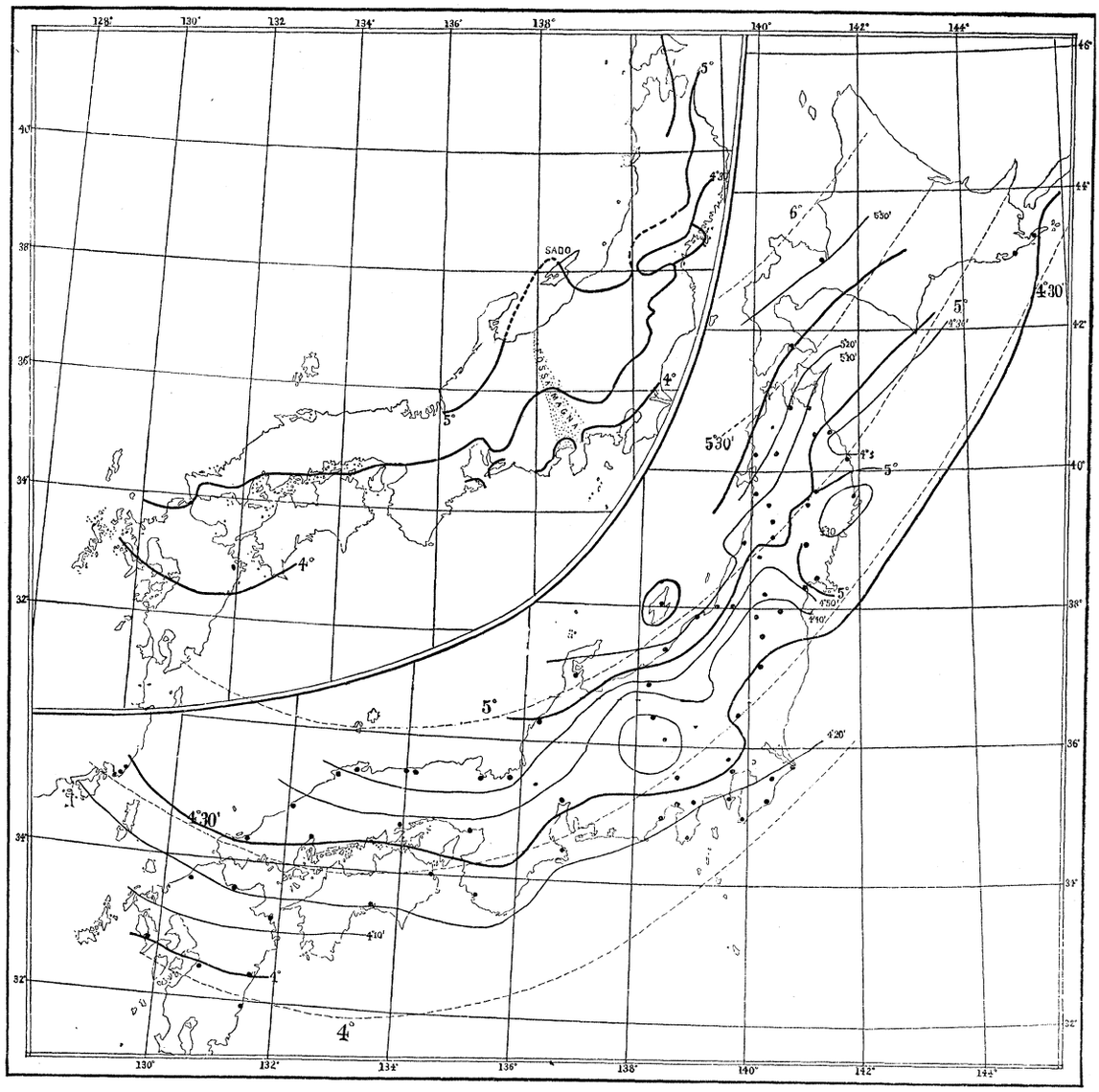
A MAGNETIC SURVEY OF JAPAN.

A RECENT number of the *Journal of the College of Science* of Japan contains the results of a magnetic survey of the islands, carried out by Cargill G. Knott and Aikitsu Tanakadate. The determination of the magnetic elements of Japan is of peculiar interest, as the results of former researches led Dr. Naumann to the conclusion that intimate connections exist between magnetic elements and geological structure. This opinion was based on the magnetic survey of Japan, carried out by Messrs. Sekino and Kodari in 1882–83. A careful review of the methods and results of this survey was therefore very desirable, and Dr. Knott undertook this task. He found that it would be unsafe to deduce from them any definite conclusions as to the general magnetic characteristics of Japan. His principal reason was the inadequate selection of routes, and the fact that the observations were made in two sets, — one in the fall of 1882, the other in the fall of 1883, — the observations being made usually about 9 A.M. or 3 P.M., but not with absolute regularity. He found that no satisfactory attempt had been made to reduce all observations to one hour.

It thus appeared that the thing to be desired was a new survey, — what might be called a preliminary survey of all Japan, special attention to be paid to the distribution of stations. The work was carried out by two parties, one visiting the northern half of the territory to be studied; the other, the southern half. In selecting the stations, two considerations were principally borne in mind, — a fairly good distribution, and a shunning of local disturbances due to volcanic rocks. The second condition was extremely difficult to fulfil, particularly in the northern parts of Japan, where magnetic rocks abound.

Eighty-one stations were occupied in the course of the survey. As the results of the observation on declination are of particular interest in connection with Naumann's theory, we reproduce Knott's map of lines of equal magnetic declination. The lines were drawn by hand from consideration of the observations of contiguous stations. From these he has computed parabolic lines by the method of least squares. We have reproduced these also, although they seem to be of little value, considering the great amount of local variation. The lines as constructed by Naumann are shown for comparison on the smaller map.



MAP OF JAPAN SHOWING THE LINES OF EQUAL MAGNETIC DECLINATION. (ACCORDING TO KNOTT AND NAUMANN.)

The following remarks of Dr. Knott are of interest in reference to Naumann's theory. Based on the broad features of Sekino's chart, Naumann finds in the form of the isogonic line of 5° W. a close relation to the so-called 'Fossa Magna.' Just where this great break in the geological continuity of the country occurs, there a large sinuosity seemed to show itself on the isogonic line. This great fault, the Fossa Magna, almost stretches right across the central part of Japan in a nearly north-and-south direction. The well-known volcano Fujiyama is included in it, and so, it is generally supposed, is the line of volcanic islands stretching south-easterly. The Fossa Magna hardly reaches the northen coast of Japan; but, if continued northwards, it would be found to run between the penin-

sula of Noto on the west, and the island of Sado on the east. Now, it is just at this region that Sekino's 5° isogonic line makes a great bend to the north, doubling back just over the island of Sado, and then, after an easterly sweep, continuing north-easterly across the country. It is extremely doubtful whether the observations warrant such a delineation of 5° declination. A careful scrutiny of Sekino's numbers brings out certain discrepancies which should not altogether be neglected. Further, there is a complete lack of observations along the coast to the south and south-west of Sado, — just where observations seem most called for. The stations chosen are all inland, and show striking irregularities in the values of the declinations. True, the declinations at the three stations on Sado are all considerably less than the values at mainland stations immediately to the east, whereas we should expect to find them greater. But that seems hardly a sufficient reason for making the isogone of the form represented; for it is well known that the isogonic lines at and near islands often present irregularities of quite a local description: hence, in default of evidence which could only be obtained by a series of observations along the coast of the main island, it seems more prudent to draw the isogonic line of 5° fairly normal, and represent the disturbance due to Sado by a small isolated contour round that island. In this way it is shown on the map. As a matter of fact, every volcanic region is certain to present magnetic irregularities, and in Japan there are two regions specially to be noted as such. The one is the great central mountainous region, just where the Fossa Magna is. The other is the part between the 38th and 40th parallels, but there is nothing geologically comparable to the Fossa Magna. In both regions a prodigious development of volcanic rocks occurs, and this is presumably the reason for the irregularities in both regions.

Knott does not refer to the great horizontal dislocation which Naumann considers the cause of the northern irregularity. The question at issue is one of great interest. Local variations are observed in every country, even in those where no volcanic rocks occur; and the problem formulated by Naumann, which is a study of the local variations of the magnetic force as connected with the geological structure of the country, is well worth a thorough and continued study.

THE ELECTRIC-LIGHT CONVENTION.

THE National Electric-Light Association met in New York at the Hotel Brunswick on Aug. 29, and continued in session for three days. Pres. S. A. Duncan opened the convention with an interesting address, in which he reviewed the growth of the association and of the electric-light industry. When the association was first organized, the foreign technical papers only noticed its proceedings in order to ridicule them: now the papers read at its meetings are copied by the leading electrical papers all over the world. The membership of the association has largely increased, as has the interest taken in it by the members.

The electric-lighting industry has rapidly advanced in the last six months, since the meeting of the association held in Pittsburgh. Then it was estimated that there were in the United States 4,000 isolated plants and central stations, supplying 175,000 arc lights and 1,750,000 incandescents. To-day there are 5,351 isolated plants and central stations operating 195,000 arc and 1,925,000 incandescent lamps, employing 459,495 horse-power of steam-engines. The increase in the capitalization of the electric-light companies in the last six months has been $42,210,100.

Coming to the question of the distribution of power, there are at present 34 electric railways completed, having 138 miles of track, with 223 motor-cars; there are in course of construction 49 other electric railways, with 189 miles of track and 244 motor-cars; giving a total of 83 roads, with 327 miles of track, operating 467 motor-cars. Besides these, there are 39 other electric roads incorporated which have not yet begun construction.

Mr. Duncan then urged that the association establish a permanent office, which would be the headquarters of the executive committee, and which should contain a good reference-library, together with domestic and foreign electrical journals, and the repository of the archives of the association.

Mayor Hewitt was then introduced, and welcomed the association to New York in a characteristic and eminently common-sense speech. He dwelt particularly on the question of putting electric wires under ground, — a subject in which New York is at present especially interested. To quote one of his remarks, "I congratulate you that it [the feasibility of putting high tension wires under ground] is going to be tested by a responsible company; and until it is tested, let me say to you frankly, that, if it were in my power to compel the other companies to do this thing now, to-day, I would not do it. . . . But I hope it will succeed; and if it does succeed, no public officer will be more prompt than I shall be in compelling every electric-light company to respect the intention of the Legislature." Again, speaking of the danger of the electric currents, Mayor Hewitt summed up as follows: "I found, that, with all the difficulties of this thing, the absolute results seemed to show that it was absolutely safer than any other useful agency at work in this city."

The various papers read before the association were hardly so important as those given at the last meeting at Pittsburgh, but some of them contain valuable information. The following abstracts give the main points in each: —

Mr. S. S. Leonard, in his paper on 'Petroleum Fuel,' said that the advantages of oil over other fuels are many: it is more easily regulated, there is less attendance required, the fires can be started or stopped instantly, there is no refuse to cart away, it is cleaner than any other fuel except natural gas. The arrangements for the use of oil under the supervision of the writer are as follows: the oil is received in tank-cars holding from 90 to 150 barrels each; it is then drawn off into storage-tanks holding 320 barrels. These tanks are boiler-shaped, and are placed under ground end to end, and are connected together. Each tank has a man-hole and vent-pipe. The supply-pipes to the furnaces have valves at the tanks and at the furnace. These pipes are two inches and a half in diameter except about four feet at the furnace end, which is enlarged, and contains a small steam-pipe, which raises the temperature of the oil to 130° or 140°. The experience of the writer is, that the best burner for the oil is one that thoroughly vaporizes it before it is burnt, steam and hot air being used with it. As to economy over coal, there is a saving of from twenty to twenty-five per cent in fuel, and from forty to fifty per cent in labor. From tests recently made, the cost of oil was 70 cents per 100 horse-power per hour; of coal, at the rate of 86 cents per 100 horse-power per hour. Another test gave the cost as 80 cents for coal and 62 cents for oil. As for labor, one man can attend from seven to ten 150-horse-power boilers, while there is no dirt or ashes to haul away.

The discussion on this paper brought out no new facts, excepting, that, in view of the repeated attempts and failures of the past, there was a tendency to mistrust oil as a fuel, both as regards expense and the deterioration of the boilers. It was stated, however, that Mr. Leonard had been using oil for nine months, and was satisfied with its economy and reliability.

Mr. S. S. Wheeler, in his paper on 'Overhead and Underground Wires in New York,' reviewed the history of the Board of Electrical Control, of which he is electrician, and pointed out the difficulties that they had encountered in their work. Besides the fact that there was no precedent to guide them, the wholesale putting under ground of electrical wires never having before been attempted, the local conditions were particularly unfavorable. New York being built on a long, narrow island, the electric wires are crowded together, and the distance between points increased. The ground is full of gas, water, and steam pipes, sewer and pneumatic despatch-tubes, and the earth is saturated with gases. After describing a number of underground systems, Mr. Wheeler gave the history of the modified Dorset conduit used in New York. In the original system the conduit consisted of a bundle of parallel tubular ducts about two inches and a half in diameter, built of blocks made of a mixture of coal-tar, pitch, and gravel, cast with tubular openings running through them from end to end. These blocks were placed end to end so the openings were continuous, and were cemented together. The difficulty in this system was that the blocks were brittle and porous, and they would not remain water-tight. After various modifications, the plan finally adopted was to use parallel